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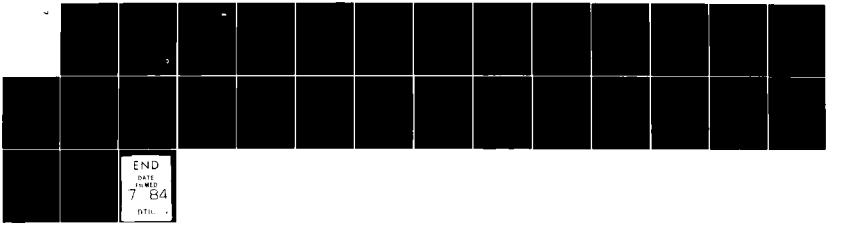

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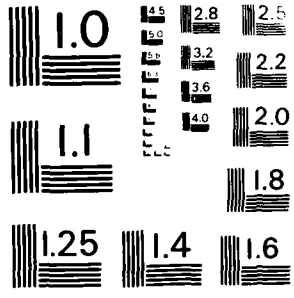

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ASSURING ENERGY SUPPLY IN A DISRUPTION

March 1984

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Executive Summary

ASSURING ENERGY SUPPLY IN A DISRUPTION

Petroleum market disruptions usually cause a rapid rise in energy prices. Higher prices make DoD's task of assuring adequate supplies of fuel for military operations more difficult. In order to assure fuel supplies, DoD's Energy Policy Office has developed a number of options for action to increase supply availability and facilitate fuel procurement during energy disruptions.

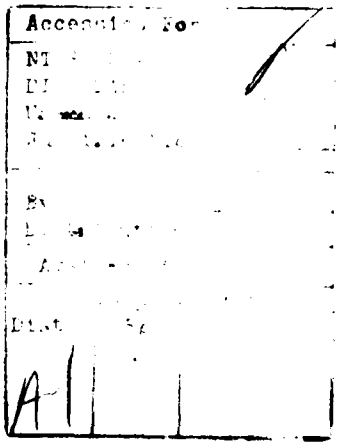
The current stable period in the market provides an opportunity to evaluate DoD supply assurance policy. There are two deficiencies in the existing policy. First, DoD has no systematic means for assessing the severity of an energy disruption. Second, while it has identified options it can call upon to respond to disruptions, it lacks a satisfactory means of deciding which options are appropriate in a given situation.

To alleviate these deficiencies, we have developed a Petroleum Disruption Response System (PDRS). Given the severity of a disruption, it selects those courses of action that should be considered to assure supplies of military fuels. The measure of the severity of a disruption has four dimensions. They are: (1) the slackness or tightness of the market, (2) the expected duration of the disruption, (3) the amount of supply lost from the market, and (4) the level of military involvement.

The decisionmaker using the PDRS will be alert to the factors determining the severity of a disruption and better prepared to monitor changes and respond effectively. We recommend that the DoD adopt the PDRS to plan for and respond to future energy disruptions.

Using the PDRS to evaluate the currently identified DoD responses to a disruption, we conclude that DoD is prepared for disruptions of mild severity but lacks response options for disruptions of intermediate severity. Additionally, DoD, which must rely on the Defense Production Act in severe disruptions, is hampered by inadequate procedures to request its invocation. To overcome these shortcomings, we recommend that DoD: (1) develop new policy options for responding to disruptions of intermediate severity, and that a Defense Petroleum Reserve be one of them, and (2) continue its joint efforts with the Department of Energy to improve the procedures leading to the invocation of the Defense Production Act.

TABLE OF CONTENTS



ASSURING ENERGY SUPPLY IN A DISRUPTION

INTRODUCTION

As well as having shared the adverse economic effects of oil supply disruptions -- rising oil prices, inflation and recession -- with the rest of the nation, the Department of Defense (DoD) has experienced problems in assuring adequate supplies of military fuels in the two 1970's disruptions.

The results of National Security Study Directive 9 and the intent of National Security Decision Directive 87 attest to the importance of energy supply disruption planning to support both the domestic economy and national security. Emergency or contingency planning for energy disruptions offers two benefits. Planning enables the decisionmaker to define the severity of the situation, to identify the options available to respond, and to react to a developing situation faster. Thus, actions to alleviate the disruption's effects can be implemented sooner. Good planning also helps the decisionmaker respond more quickly as circumstances change during a disruption.

During the past several years, DoD has developed a policy consisting of a variety of elements to assure a steady supply of military fuels during an energy emergency. Use of some of the elements of this policy would divert petroleum from the general economy into defense needs. These elements include the exchange of Naval Petroleum Reserve (NPR) and government royalty oil from the Outer Continental Shelf crude for military product and using the Defense Production Act (DPA) or other legislation to allocate supply to DoD. One element, covering contracting procedures, increases DoD's desirability as a customer during a disruption.

Not all policies would direct petroleum to DoD in a tight market. The long-term measures (using synthetic fuel, developing the Naval Oil Shale Reserve, and building weapon systems that use alternative fuels) would actually increase the supply of petroleum fuels available to the rest of the nation. The proposal to build a Defense Petroleum Reserve (DPR) would take petroleum out of the market when it is plentiful and add it to the market when supplies are tight, such as during a disruption.

Different policy elements require different amounts of time to implement. In the short run, DoD must rely on policies that either reallocate petroleum from the civilian sector to the military, or reduce operational levels and use wartime reserves. In the long run, DoD's actions contribute to increasing the supply of fuel in the market. Some of the options, such as invoking the DPA, are fairly draconian; most are milder measures designed to avoid disturbing markets more than necessary. The question we propose to answer is, "How does one know which policy options to activate in any given crisis?"

This report presents a tool for use by decisionmakers to improve planning for energy emergencies. We assume that the threat of a future petroleum disruption exists and that the first thing decisionmakers must do is assess the severity of the disruption. The tool incorporates the ability to examine the combinations of factors which determine that severity.

Not all of the factors directly affect DoD's fuel procurement. However, they do have indirect effects that may lead to a tighter fuel market than expected or may influence the political acceptability of initiating certain actions. DoD needs an understanding of the factors and their relationships in order to employ available policy elements in the most effective manner. In this report we present the Petroleum Disruption Response System (PDRS) which organizes the factors characterizing disruptions to determine the disruption's

severity and then relates the policy options applicable to the severity of the situation.

THE DIMENSIONS OF A DISRUPTION

To integrate the factors affecting disruption severity, we have grouped them along four axes: 1) Level of Disruption, 2) State of the Market, 3) Perceived Duration of the Disruption and 4) Level of Military Involvement. This four-dimensional system is illustrated in Figure 1. While each axis really represents a continuum, for simplicity of presentation each axis has been divided into discrete intervals. Each dimension is discussed below.

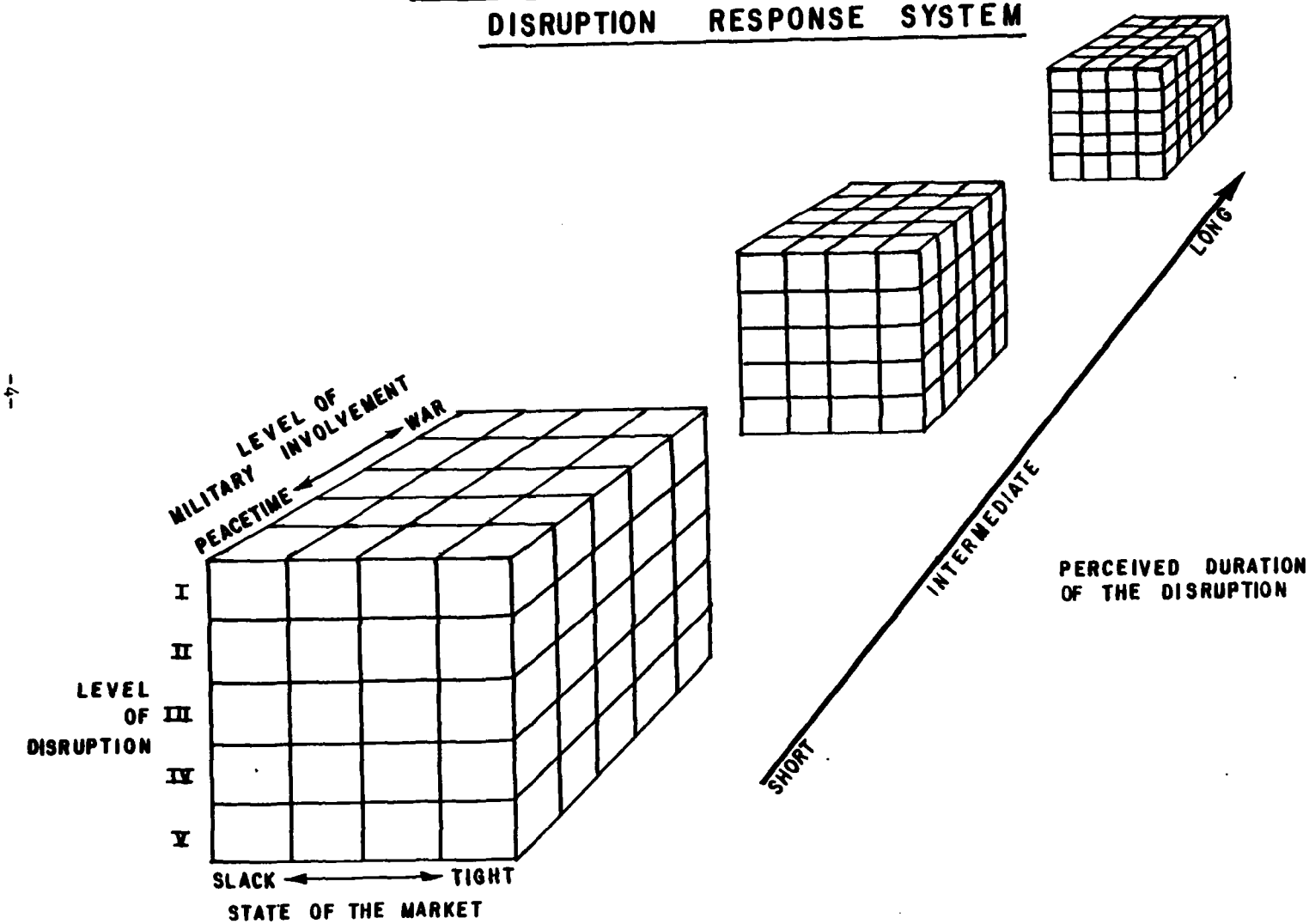
Level of Disruption

The level of disruption indicates how much supply is lost from the market. National Security Decision Directive (NSDD) 87 is a Top Secret document which called for a study of emergency planning for future energy disruptions. The Directive laid out a series of scenarios of disruptions which examined different amounts of supply lost from the market. The scale used for the dimension, Level of Disruption, follows the levels set for the scenarios in National Security Decision Directive 87. Level V is the least severe.

State of the Market

The state of the market is an assessment of the slackness or tightness of the petroleum market just before the disruption. It is the most complex dimension because it aggregates physical, economic, political, and DoD-specific factors. The first set of factors in the market dimension is "physical" because it describes physical quantities of potential supply that can be used to replace the disrupted oil supply. These factors are levels of inventory, the number of barrels in the Strategic Petroleum Reserve (SPR), the amount of excess capacity in the world, the location of that excess capacity, and the amount of dual-fuel capability.

FIGURE I. THE FOUR DIMENSIONS OF THE PETROLEUM DISRUPTION RESPONSE SYSTEM



Physical Factors. The existence of high inventory levels at the time of a disruption will tend to make the disruption less severe. In 1979, and again in 1980, energy supplies were disrupted. The effect in 1979 was severe because inventories had been drawn down before the 1979 disruption. But, the 1980 disruption had a negligible affect, because inventories had been rebuilt by the time that disruption occurred.

The existence of the SPR would have the same effect as a high inventory level. There are now about 300 million barrels in the SPR, moving toward a goal of 750 million barrels. SPR oil would replace some of the supply lost during a disruption, preventing panic buying and holding down increases in the world price of crude.

The amount of excess capacity in the world and the location of that capacity also influence the state of the market. Although excess capacity is not as readily available as inventory, it still represents supply that can be brought to the market to replace lost supply. Excess capacity is hard to quantify, because the definition depends on the time available. In the short run, excess capacity comes from already developed fields. For example, the OPEC nations have a production capacity of 31 million barrels per day. The 14-million-barrel difference between this capacity and current production of 17 million barrels a day is excess capacity. This production could come on line quickly, since the wells and equipment are mostly in place. If the time available is expanded, excess capacity expands also. In the long run, known fields requiring further development can be brought into production and can be thought of as providing excess capacity. A good example is the Alaskan North Slope field. The oil was discovered in 1968 and the field was developed, but it was not producing because there was no way to transport the oil to the lower 48 states. After the 1973 embargo, legislation was passed to

allow completion of the Trans Alaskan Pipeline. The Alaskan North Slope field provided excess capacity that the United States was able to bring on line when it needed the oil. In the earlier OPEC example, the additional capacity would be available almost instantaneously; in the Alaskan example, the time required was a couple of years.

The location of the excess capacity is also a factor. Capacity located within the territorial United States is the easiest to exploit. Although there is no shut-in capacity now, government and industry can expedite development of known reserves, as in the example of the Alaskan North Slope. It is assumed that excess capacity controlled by friendly countries such as Mexico and Britain would be more accessible than that controlled by OPEC.

A final factor affecting the replacement of disrupted supply is the amount of dual-fuel capability. Unlike inventories and excess capacity, which replace disrupted oil with oil from another place, dual-fuel capability allows replacement of lost supply with an alternative fuel. After two disruptions in the 1970's, the nation has increased the number of facilities that can burn more than one fuel. Utilities and industrial plants now take advantage of cogeneration. To the extent that the capability exists, it enables the United States and the military to withstand disruptions more easily. The availability of synthetics and some of the more exotic alternative fuels also increases the choice of fuel for these installations.

Economic Factors. The next set of factors is economic. It includes the level of business activity, the level of imports and Federal Reserve policies. The level of business activity is important because it affects the demand for energy. An expanding economy demands more energy than an economy in a slump. The market would be much tighter if a disruption occurred when

the economy was expanding and businesses were pushing toward an energy resource constraint than if it occurred during a recession.

The demand for petroleum imports is not completely distinct from the level of business activity, since the demand for imports rises with the demand for energy. Import demand is also affected by domestic production which is influenced by the economics of exploration and development. If a disruption occurs, the country will not be able to avoid paying the higher energy prices that result. However, the United States will have more flexibility if the level of imports is lower.

The policies of the Federal Reserve Board influence interest rates, which influence business activity, which affects petroleum demand. In addition, the oil industry itself, as part of the economy, is affected by Federal Reserve policy.

Government-Political Factors. The next set of factors includes the administration's preferred policies for dealing with an emergency, the public's perception of the severity of the situation, and the Windfall Profit Tax. Each administration will have a preferred way of dealing with energy emergencies. The current administration advocates relying on free markets to allocate supply in an emergency; some administrations have felt price controls and allocation regulations were best for the country. When a disruption occurs, there is generally pressure for price controls and allocation, so there is always a possibility that we will again regulate the market. But, we have ample evidence that regulation does not work very well and that many of the market distortions it causes harm the economy. If the political leadership does opt for controlling the market during the next disruption, the effects of the disruption will be more severe than if controls were absent. It is not clear exactly what results would come from letting the

market allocate supply, since the nation has never tried that policy during an energy emergency.

In the past, government policies have affected participation in the spot market. "Spot" sales of crude are those made for single cargoes on a one-time-only basis. The spot market is useful in bringing supply and demand into balance, because it gives price signals for the marginal cost of petroleum. Between 1973 and 1980, very little domestic crude was "spot," because government regulations for crude prices and allocations proscribed spot sales. During the period of rapid price increases in 1979, the government tried to prevent domestic oil companies from purchasing crude in the spot market through "jawboning."

Another important area controlled by government policies is the use of the SPR, which is certain to be controversial in the event of a disruption. The current SPR Drawdown Plan imposes almost no specific requirements but leaves most decisions to Presidential discretion.

An important factor among the government-political factors is the public's perception of the disruption's severity, since the public will exert a great deal of political power. During a disruption, oil prices rise and there are negative effects on the economy. Each special interest group can be expected to lobby to protect itself and to try to shift the pain elsewhere in the economy. Legislators are likely to be responsive to constituent arguments, and it is unlikely that the market will be left totally "free."

The Windfall Profit Tax is due to expire in 1992. Until then it will exert a little-known influence on the oil market during a disruption. This legislation permits owners of crude inventories to draw them down without being penalized financially. This provision of the Tax would encourage holders of inventory to draw down the inventory sooner, thereby adding some slack to the market.

DoD-Specific Factors. The disruption of specific crude streams, directly affects DoD. Certain crudes are more easily refined into military products. Although this is a concern now, refinery configurations will change over time, allowing less desirable crudes to be refined to military specifications.

The state of the market has been divided into four levels based on the action of real prices. The first level is a slack market in which the real price of crude is falling, as in 1974 and 1975. A moderate market is characterized by stable real prices for crude and a moderately tight market is characterized by slowly rising real prices. A tight market is one in which real crude prices are already rising rapidly even before the disruption begins.

Perceived Duration of Disruption

The third dimension is the perceived duration of the disruption, which is important because it determines which policy measures can be implemented in time to be effective. We have arbitrarily divided disruptions into three periods based on the potential to make changes in capital assets. In the short term, herein defined as not more than six months, capital assets are fixed, and ways to affect energy consumption are limited. New energy-efficient equipment cannot be purchased quickly enough, buildings cannot be insulated instantaneously, and consumers do not immediately purchase small cars. The nation must handle an energy disruption largely by drawing down the SPR or by doing without. We assume that "doing without" will be the policy chosen in the short term. Then, if the market is left relatively free, gasoline prices will rise and people will curtail their driving. Or, if gasoline prices are controlled below market prices, people will wait in line. Other short-term emergency measures include carpooling, fuel switching, power

wheeling by utilities, and reduced use of outdoor lighting. All these measures require no change in capital assets but are directed toward quickly reducing energy use. If the perceived duration is less than six months, the tendency would be to rely on policies that encourage fast and easy conservation.

In the long term, defined as more than two years, capital assets will be changed and many permanent changes in operations and lifestyle will take place. In the 1970's, many perceived OPEC's control of oil prices to be permanent. The resulting change in capital assets are perhaps most obvious in industry. Many utilities converted to coal, a signficant amount of dual-fuel capability was installed, and many industrial installations replaced old equipment with energy-efficient models. On the consumer side, many houses now have insulation, and new houses are being built to be more energy efficient. Our fleet of cars has improved fuel efficiency; even the largest cars have better gas mileage than they did in 1970. Most of these changes are permanent and have occurred over a period of years in response to the 1973 and 1979 disruptions.

An important part of the time dimension is the response of crude oil producers to higher prices. If producers perceive a long-term loss of supply, implying higher prices in the long run, they will invest more in exploration and development to bring more crude supply into the market.

Long-term policies are those which encourage a permanent replacement of petroleum fuels. Again, the types of measures people take are based on their perceptions of the duration of the disruption. In the short run, they will not invest in changes in capital equipment. On the other hand, if they perceive a permanent loss of supply, they will invest in energy-efficient equipment.

We also define an intermediate-term disruption, from 6 months to 2 years, to acknowledge that transition from short term to long term is not abrupt. In this period, easy conservation measures and the SPR will not suffice. There will be some long-term initiatives, but not as many as if the loss of production were to be perceived as permanent.

Level of Military Involvement

The last dimension is the degree of military involvement. This set of factors, of primary importance to DoD, is for some reason rarely taken into account in analyzing the effects of energy disruptions. A variety of factors is covered in this dimension: the origin of the crisis, the type of military involvement, any coincidental military involvement, the duration of the involvement, feedback from the civilian sector, and requirements of the defense industrial base. Military involvement is important because of its effect on the demand for military fuels. The origin of the crisis generally determines whether or not there will be military involvement. For example, loss of crude supply due to a natural disaster would not require military involvement. The levels of military involvement in energy crises involving OPEC will vary; the fall of the Shah in Iran led to some power projection in the Indian Ocean, but the war between Iran and Iraq was not seen as requiring a military response from the United States. A loss of crude supply due to actions by the U.S.S.R. or its client states is likely to precipitate some military activity.

The origin of the crisis also affects the level of military involvement required. In general, the more serious the event causing the disruption, the higher the degree of military involvement. This factor takes into account whether there will be force movements, involvement of contingency operation plans, or higher states of military readiness, and what types of equipment

will be involved. These determine the types of fuel required, the amounts, and the location of the demand.

Apart from the energy crisis, the military may be responding to another situation, and military fuel consumption may already be above average peacetime levels. If an energy disruption occurs with coincidental military involvement, DoD will have more trouble providing supplies.

The duration of involvement brings time into the military involvement dimension. If the involvement is expected to be a short one, the circumstances are less severe and the energy situation is less serious. Conversely, long-term activity requires severe measures to assure the supply of military fuels.

Feedback from the civilian sector occurs here for much the same reason that public perception appears under the government-political group. Especially in a peacetime emergency, there is likely to be localized response to increased military demand. An example of this feedback is that some West Coast training exercises were cancelled in 1973-74 in deference to the civilian energy situation, even though the military had adequate supplies of fuel to conduct them.

The last factor in this dimension is the needs of the defense industrial base. At some point of severity, assuring supply to the industrial base will be as important to national security as direct supply to the military. This requirement may increase the strain on certain regions and on specific industries in the nation and intensify civilian feedback.

The military involvement dimension has been divided into five levels following a Department of Energy schema in the claimancy manual[1] for invoking

[1]"The Federal Energy Resource Manual," Department of Energy, Deputy Assistant Secretary for Energy Emergencies, Draft 2, Appendix Z, July 1983.

the DPA. The first level is peacetime, involving no military action. The next level is a military alert, which would include power projection by the United States into various parts of the world. The third level is partial mobilization, and troop movements would begin. The fourth level is general military and industrial mobilization, or intensive preparation for war. The final level is actually fighting a war.

CONSTRUCTING THE POLICY TOOL

When a disruption occurs, the decisionmaker can use the four dimensions to locate the severity of the emergency. The decisionmaker is also aware that the policy elements chosen to alleviate the problems of the disruption should match the severity of the policy to the severity of the disruption. Figure 1 showed a disruption's dimensions using a series of cubes. It remains for us to match policy elements to cells within the cubes. Table 1 displays the DoD supply assurance policy elements now in place, plus three proposed policy elements.

TABLE 1. SUPPLY ASSURANCE POLICY ELEMENTS

1.	Do nothing.
2.	Exchange NPR crude for military product.
*3.	Exchange Outer Continental Shelf crude for military product.
4.	Waive certain contracting requirements.
5.	Put pressure on the Department of Energy to draw down the SPR.
*6.	Draw down the DPR.
7.	Propose emergency legislation to meet DoD needs.
8.	Seek DPA invocation.
9.	Increase use of synthetic fuel.
*10.	Develop Naval Oil Shale Reserve.
11.	Build weapon systems that do not use petroleum.
12.	Dip into petroleum war reserves.
13.	Cut back on operations.

*Proposed

All the policy elements in Table 1 are actions that could be initiated by DoD. Actions by the President and other agencies will affect DoD, but they are not considered here. The policy elements are arranged roughly in order of their severity. Severity is a function of the time required to implement the policy, the amount of effort required, and the desirability from the military's viewpoint. Dipping into war reserves and cutting back on operations are last because they are highly undesirable to the military during peacetime. Elements 1-7 are high on the list because they are easy to implement. Some of the elements in the list are in the proposal stage. DoD does not have access to Outer Continental Shelf crude, but such access could be provided in the same way that access to NPR crude is now provided. This element is high on the list because it would be easy to implement once the procedure is in place. Another proposal is to build a DPR similar to the SPR, but only for defense needs. The DPR could be structured in a number of ways. It would require considerable effort but, once in place, it should be easy for DoD to draw down. The elements involving the development of alternative fuels and weapons not using petroleum have long lead times and would be more difficult to implement. This is not meant to be an exhaustive list. One of the advantages of the system as presented is that policy elements can be added or dropped.

Figure 2 demonstrates the 2-dimensional matrix formed when military involvement and the duration of the disruption are held constant at the lowest levels. For example, we assert that it would be reasonable to "do nothing" during a small disruption in a slack market. The policy elements used become more drastic as the market gets tighter and/or the disruption gets larger.

FIGURE 2. MILD ACTIONS WOULD SUFFICE FOR A SHORT DISRUPTION WITHOUT DIRECT MILITARY INVOLVEMENT

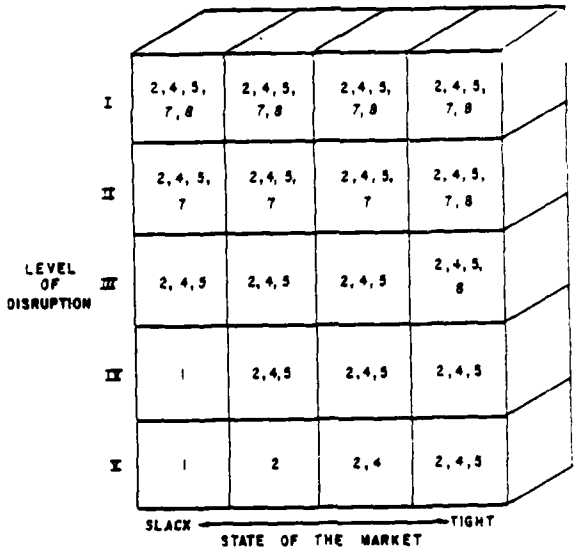


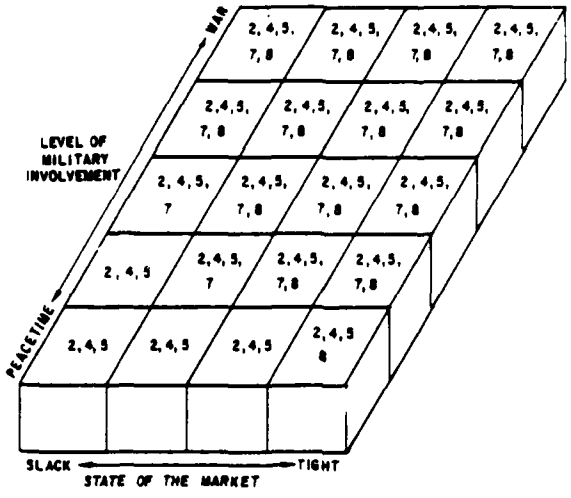
Figure 3 shows a horizontal slice of the cube for a short-term disruption. The level of disruption is held constant at 7 million barrels a day. Since military involvement increases, the policy elements used are some of the most severe for a short-term disruption.

By moving systematically through all four dimensions, we can fill each cell with the appropriate policy elements. The next section of this report presents the complete system with policy elements matched to each disruption created by the intersection of the four dimensions.

MATCHING POLICY OPTIONS TO A DISRUPTION'S SEVERITY

Figures 4, 5, and 6 show policy elements to be implemented in a short-term, an intermediate-term and a long-term disruption, respectively. The policy elements are listed by number from Table 1.

FIGURE 3. A SHORT DISRUPTION OF 7 MILLION BARRELS PER DAY WOULD REQUIRE MORE DRASTIC ACTION

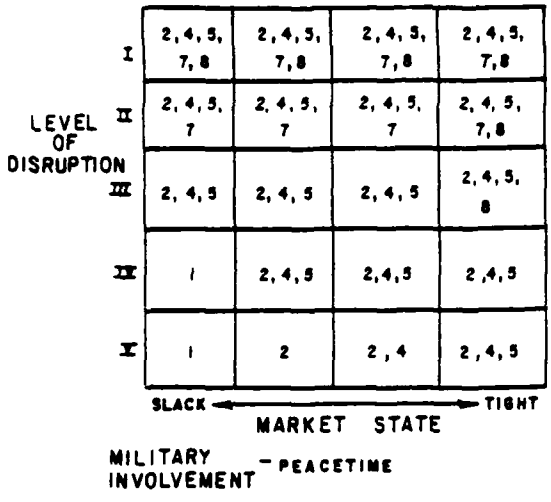


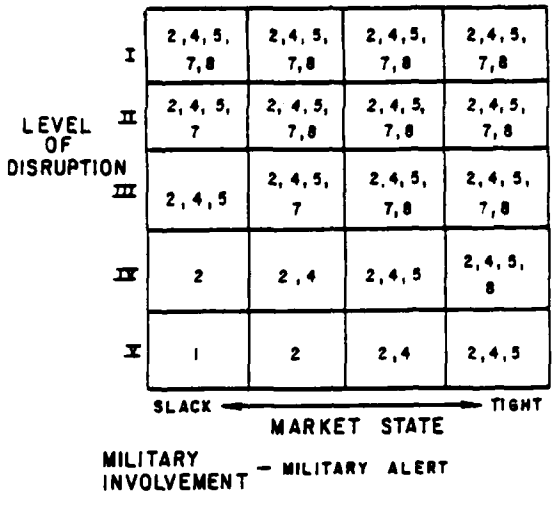
In general, policies to reallocate crude are relied upon for disruptions lasting up to two years. In a long-term disruption, policy elements that lead to additional supply are the important ones. This is a critical distinction, because when DoD takes actions to reallocate supply during a disruption, many of the factors in the economic and government-political groups are affected. Most of these actions would usually make the market tighter. DoD's long-range options, however, have the opposite effect and would ease a tight market by adding supply.

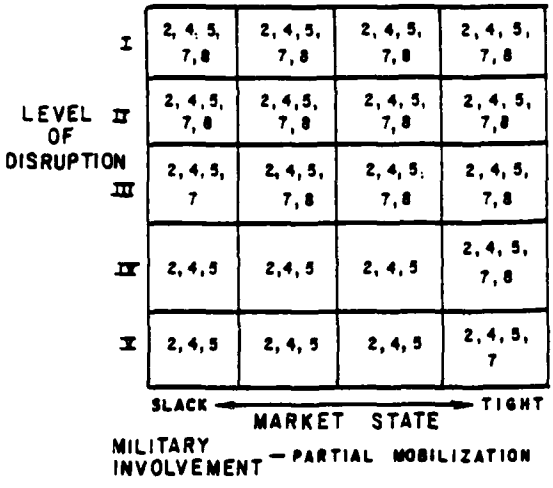
FINDINGS AND CONCLUSIONS

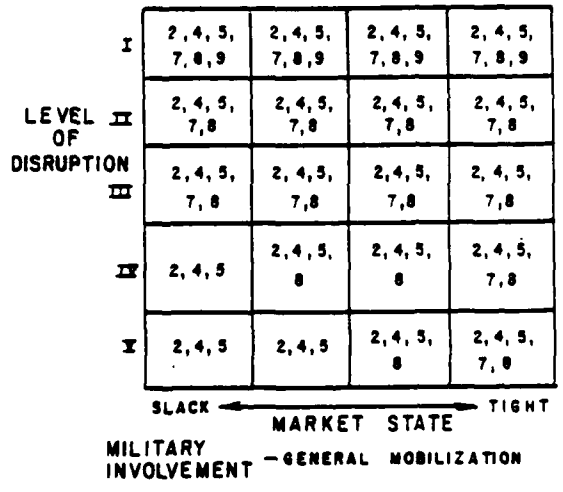
The exercise of matching policy elements to the severity of a disruption produced several observations. The first was that it is easier for DoD to deal with the extreme situations. In a severe disruption, the DPA is the only option, within the current range of elements, to assure supply. For short-term, minor disruptions, the DoD's choice of options is less critical, because the situation will correct itself. Within the wide range of

FIGURE 4. SHORT DISRUPTION









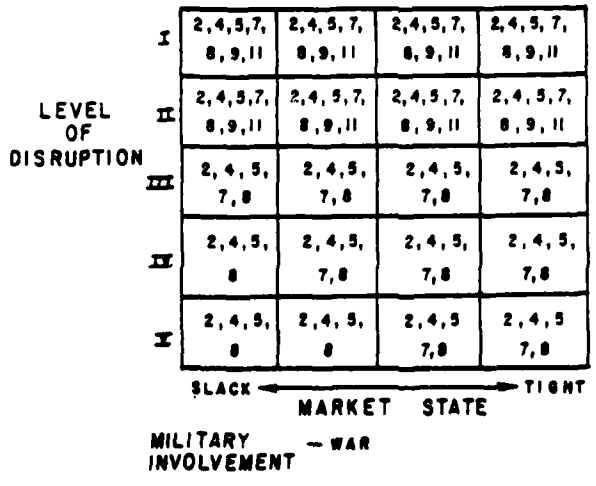


FIGURE 5. INTERMEDIATE DISRUPTION

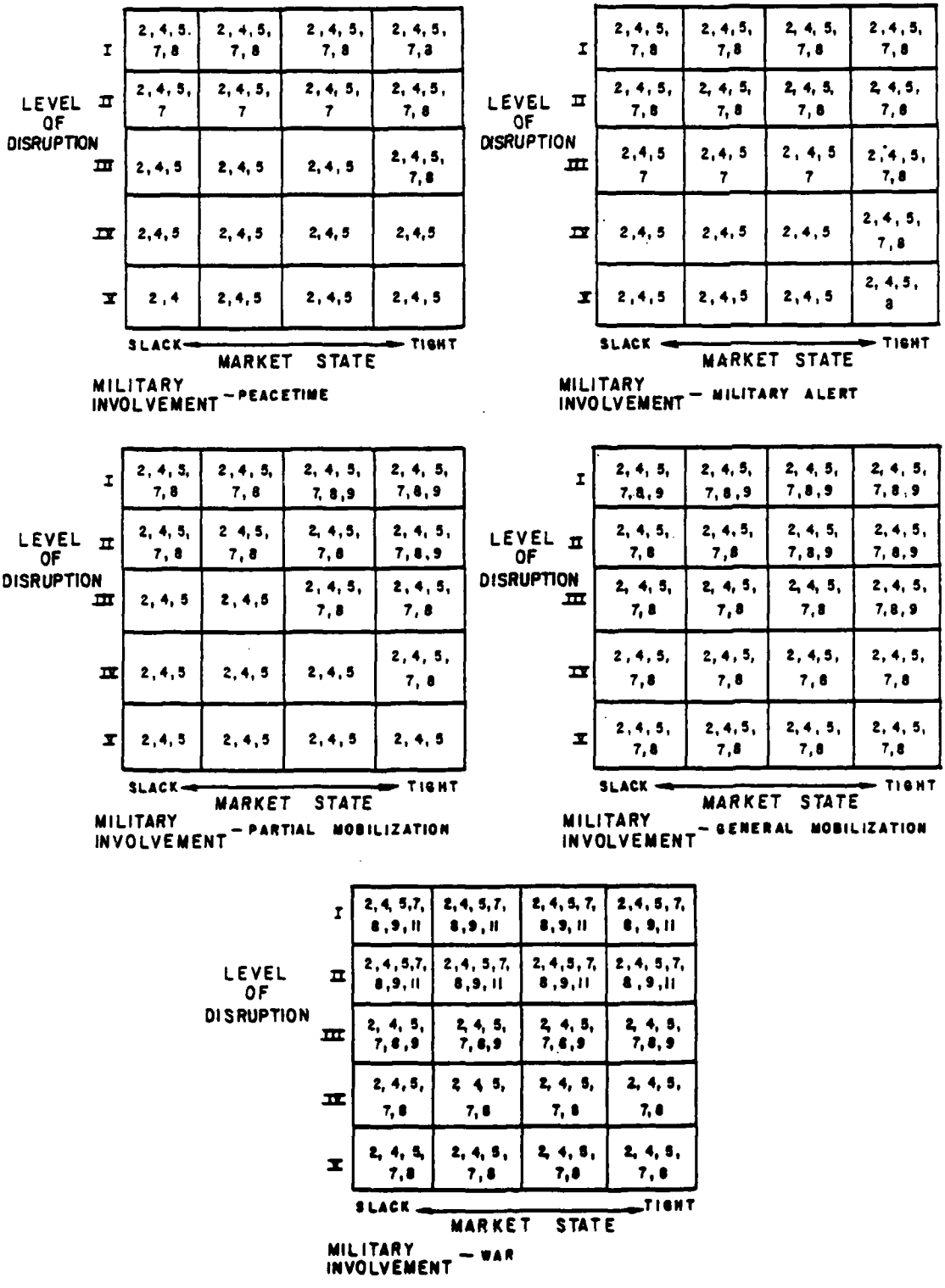
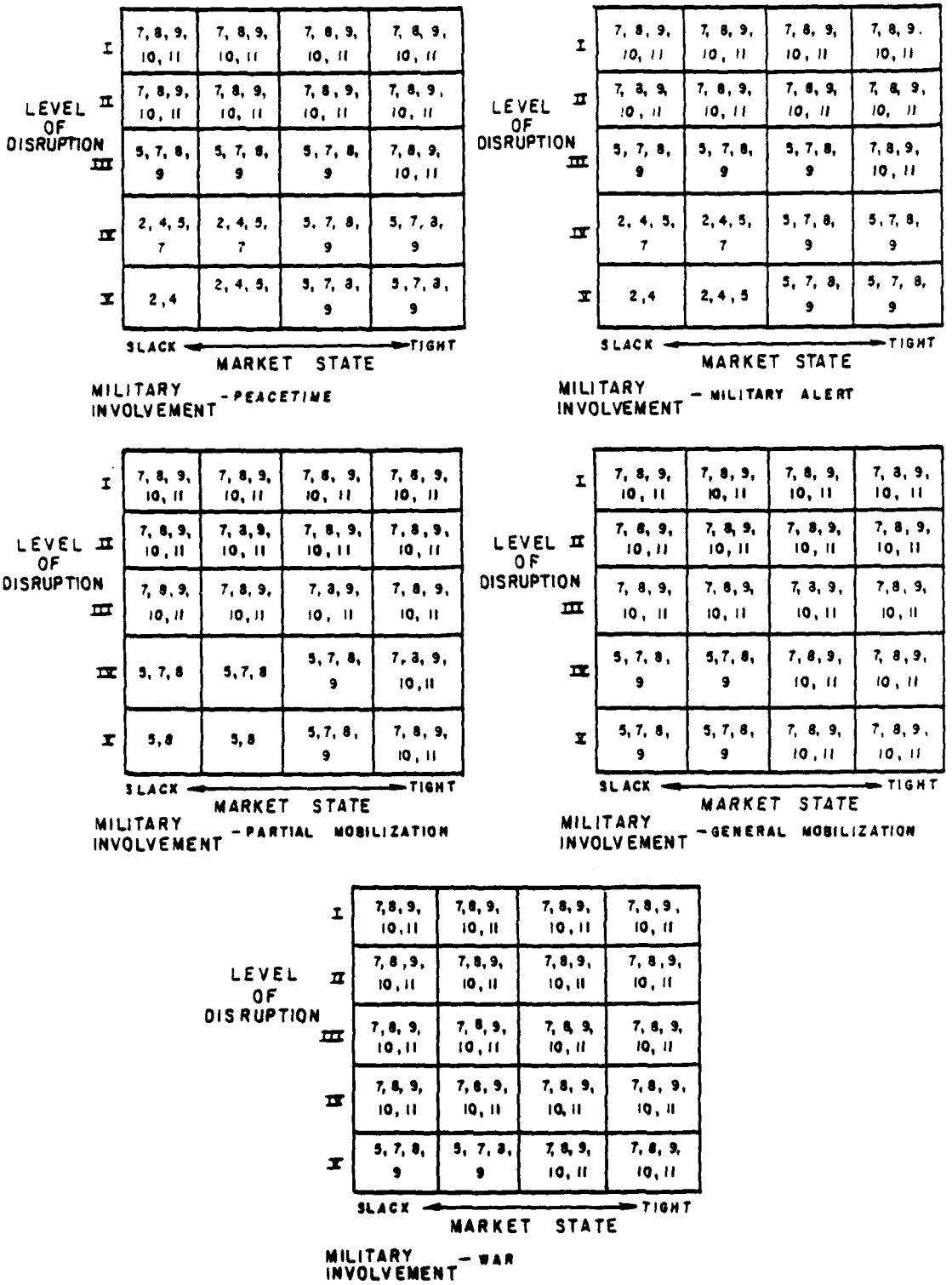


FIGURE 6. LONG DISRUPTION



moderate disruptions, DoD does not have much flexibility, because it does not have a choice of policy elements which are not used in minor disruptions.

Another observation is that the list of policy elements must change over time. Eventually, the NPR crude exchange will not be an option because the natural decline in NPR production will eliminate it as a source of supply. Over time, synthetic fuels should become more available and play a more important role.

The remaining observations concern specific options. The long-range policy elements of (1) using synthetic fuel from coal and oil shale and (2) building systems that do not use hydrocarbon fuel will probably develop at a slow rate. If a disruption does not occur, they will be eased into the structure gradually. A long-term disruption would probably make them the focus of a crash effort and bring about earlier implementation.

In the meantime, there is a heavy dependence on use of the DPA for a wide range of circumstances. This points out the importance of this legislation and the significant role it plays in DoD supply assurance. Procedures to ease the invoking of the DPA deserve the high priority they now have.

One policy element is for DoD to call upon the Department of Energy to make the SPR available during an emergency. DoD would then be able to purchase crude at the prevailing price. However, DoD does not control the SPR, and it would be naive to assume that the SPR will automatically be available in future disruptions.

Drawing down a DPR would change the situation completely. Policy element 6 (DPR) appears in Table 1, but it does not appear in any matrix, because it is now only in the discussion stage. A key question on the usefulness of a DPR is whether the Department of Energy or the DoD would control it. We assume that DoD would have complete control; otherwise the DPR would resent

the same problems as the SPR. Having a DPR would lessen DoD's reliance on the DPA in many circumstances; i.e., use of the DPA probably would not be considered for a short-term disruption unless there was high military involvement. Drawing down a DPR would also be beneficial to the nation because this action would add supply to the market instead of reallocating supply. Having a DPR could eliminate DoD interest in the SPR, and policy element 5, calling upon the DoE to draw down the SPR, could be dropped. In a long-term disruption, a DPR would provide breathing room while DoD initiated the long-range policy elements.

Policy element 3, exchanging Outer Continental Shelf royalty oil for military product, is also in the proposal stage. This oil could supply all of DoD's needs during a disruption; however, the exchange would reallocate oil and cause dislocations elsewhere. Nevertheless, this option should be pursued, because NPR production will continue to decline and DoD does not have many other options for short term disruptions.

Policy elements 12 and 13, using war reserves and cutting back on operations, do not appear as entries in the tables. While these actions are available to DoD, and in fact have been used in the past, they may not provide supply assurance and are not preferred actions. The hope is that good management of supply assurance during the next disruption will eliminate the need for these options.

SUMMARY AND RECOMMENDATIONS

The Petroleum Disruption Response System aids contingency planning. It affords managers a structured framework for examining the potential DoD consequences of an energy disruption. New policy elements can be fitted into the framework, and the interaction among old ones can be re-examined. Decisionmakers can see the implications of a worsening situation, and they can be prepared to move quickly to implement the necessary policy elements.

The framework presented above is not meant to be a formula; it does not replace judgment. It is intended to provoke thought about the variety of factors which determine the severity of a disruption and to provide guidance in finding responses appropriate to specific situations. With its use, managers can be prepared to act rapidly and effectively when required and can avoid overreaction.

We recommend the DoD adopt the Petroleum Disruption Response System as an aid to future planning for energy emergencies. It should seek additional options for responding to moderately severe disruptions. We recommend that it pursue the establishment of a Defense Petroleum Reserve as an important contribution to supply assurance during intermediate-range disruptions.

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DoD has two deficiencies in its supply assurance policy which is used to assure supplies of military fuels, particularly during energy emergencies. First, DoD has no systematic way of assessing the severity of a disruption and second, DoD has no systematic way of deciding which policy options to put into action in response to a particular situation.

This report provides a system which eliminates both deficiencies. The system provides a way of defining the severity of a disruption by

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aggregating all the factors which influence an energy emergency into four dimensions. After the disruption is scoped, the system provides a way of determining which policy options are suitable for the situation.

This report also provides an evaluation of the adequacy of current supply assurance policy options and recommends that additional options be developed for an intermediate level disruption.

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